



# Maxine Frank Singer

GRFP Recipient: 1952

*Undergraduate Institution:*  
A.B. 1952, Swarthmore College

*Graduate Institution:*  
Ph.D. 1957, Yale University

*Field of Study:* Biochemistry

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*Current Position:*  
President Emeritus, Carnegie  
Institution for Science; Scien-  
tist Emeritus, National Cancer  
Institute., National Institutes  
of Health; Senior Science Ad-  
visor to the Carnegie Acad-  
emy for Science Education,  
the Carnegie Institution for  
Science

## RESEARCH INTERESTS //

Maxine Frank Singer began working on RNA enzymology when she joined the National Institutes of Health after completing her Ph. D. She collaborated with Marshall Nirenberg in the research leading to a definition of the genetic code beginning in 1961. In the early 1970s, she began studying the structure of the DNA in defective Simian Virus 40 genomes. In the 1975 she was one of the organizers of the Asilomar Conference on Recombinant DNA Research and thereafter she helped develop guidelines for carrying out this research. These guidelines called for a balance between the use of recombinant DNA methods to advance understanding of biology and restrictions on the research to protect scientists and the public from any possible harmful consequence. Recombinant DNA research has been of central importance to advances in biology and medicine ever since. Meanwhile, her work on Simian Virus 40 DNA led to work on the repetitive DNA in human genomes. One of the dispersed repeated sequences discovered by Singer and her coworkers, which they named LINE-1, makes up 17 percent of the human genome. LINE-1 is a moveable element and new insertions of LINE-1 DNA into the genome are now known to cause mutations some of which associated with cancer cells.

## BROADER IMPACTS OF MY WORK ON SOCIETY //

I am pleased that the efforts on the genetic code were successful and have had a huge influence on the progress in genetics and molecular biology over the past 50 years. Our research on the LINE-1 moveable element opened the door to understanding an important source of variation in human genomes. The importance of my and my colleagues leadership on the Recombinant DNA Research issue including organization of the 1975 Asilomar Conference and the development of the guidelines thereafter stand as an example of the role that responsible scientists should play in bringing relevant issues to the public.

## A FOND MEMORY OF MY EXPERIENCE AS AN NSF GRADUATE FELLOW //

I was fortunate to do my undergraduate studies in chemistry at a small, co-educational college where women were encouraged to study science. Although there were fewer than 200 people in my class, 5 of the women were awarded Graduate Research Fellowships in the first year of the program when only 32 women received the award nationwide. My Graduate Research Fellowship allowed me to pursue a Ph.D. degree. My husband, who was a law school student, and I lived on the \$1800 per year stipend. I was very proud when, in 1987, our youngest daughter, Stephanie Singer, was awarded a Graduate Research Fellowship to pursue her Ph.D. in mathematics.

## AWARDS/ HONORS //

Over 10 honorary doctoral degrees and 40 honors and awards, including:

- Member, National Academy of Sciences (1979)
- Member, Institute of Medicine (1979)
- Pontifical Academy of Sciences (1986)
- National Medal of Science “for outstanding scientific accomplishments and her deep concern for the societal responsibility of the scientist” (1992)

## POSITION PROFILE //

- 1974 – Chief, Section of Nucleic Acid Enzymology, Division of Cancer Biology and Diagnosis, National Cancer Institute, National Institutes of Health
- 1975 – Organizer, Asilomar Conference
- 1979 – 1988, Chief, Laboratory of Biochemistry, National Cancer Institute, National Institutes of Health

